

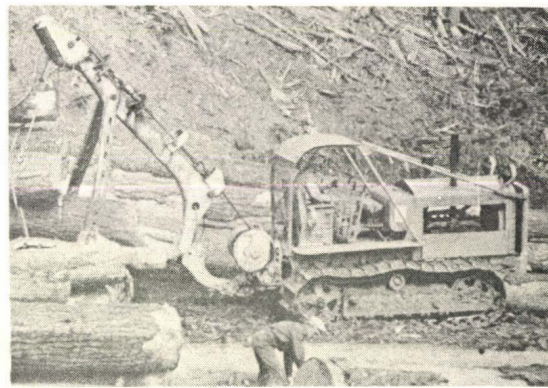
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RESEARCH

NORTHEASTERN LOGGERS' HANDBOOK

by

Fred C. Simmons

PRELIMINARY REVIEW EDITION



Easier and Safer Work



Greater Production (more pay) and Better Living Conditions

SECTION 12:— WIRE ROPE AND ACCESSORIES

NORTHEASTERN FOREST
EXPERIMENT STATION



United States Department of Agriculture

FOREST SERVICE
NORTHEASTERN FOREST EXPERIMENT STATION

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If you want to be a mechanic, you will easily find plenty of good books which will tell you what you need to know. You will also find plenty of instructors and training shops.

What about the young man who wants to make his living by logging? For him there is no good source of information to which he can turn. The books and courses on logging are for the logging engineers--not for the fellow who uses the axe and crosscut.

Why shouldn't there be a simple illustrated handbook which will tell the young woodsman (or the green woodsman) what he needs to know about the care and use of his tools and the best of the old and the new techniques of, and devices for logging? He needs to know the "tricks of the trade" as much as anyone.

We hope that these pages, together with other short papers like it, will finally be put together in a printed NORTHEASTERN LOGGERS' HANDBOOK. We are putting it out in this form first because there seems to be an urgent need for this sort of information; and because we need the help and advice of persons who know about logging in our region before printing. We want the experienced logger to tell us what important things we have missed and where our advice is not good. We want the young man going into the woods for the first time to tell us what parts of it he finds hard to understand, to suggest how it can be made more useful to him. We would like the equipment manufacturers to check our recommendations for use of their products and tell us about new devices they are developing.

Please send criticisms, questions and suggestions to: The Director, Northeastern Forest Experiment Station, 614 Bankers Securities Building, Philadelphia 7, Penna. Additional copies of this and other publications in this series can be obtained from the same address.

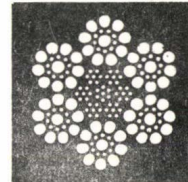
SECTION 12: SELECTION AND USE OF WIRE ROPE AND ACCESSORIES

By Fred C. Simmons*

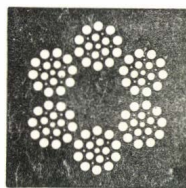
Wire rope is so important in modern logging operations that this special section has been devoted to it.

TYPE AND SIZE OF ROPE

A great many kinds of wire rope are available. The best for use as a logging dragline is a 6 x 19 (6 strands, 19 wires in each strand) rope of improved plow steel with an independent wire rope center (I.W.R.C.). A Seale pattern rope of this type has large-diameter outer wires which give maximum resistance to abrasion.



SEALE
PATTERN
I W R C



6 x 19
FILLER WIRE

A wire rope with a hemp center is more flexible, but cannot stand the crushing stresses of the winch drum so well. However, this rope is well adapted for use as chokers, since it is more flexible and has greater resistance to bending fatigue. A 6 x 19 rope of this type is amply strong for use as chokers.

The size of the rope is determined by the loads it will be expected to haul. With a safety factor of 6 times for logging service, the rated strengths of I.W.R.C. plow-steel wire ropes, by size, are:

Rope diameter (inches)	Safe load (2,000-lb. tons)
3/8	1.1
1/2	1.8
5/8	3.0
3/4	4.3
7/8	5.8
1	7.5

Hemp-center rope has about 8 percent less strength than I.W.R.C. rope of the same pattern and size.

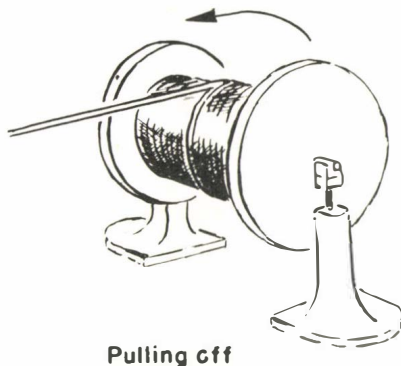
* Specialist in harvesting and primary processing.

In both types it is well worth the additional cost to get rope of preformed construction. This simply means that each wire and each strand is formed into a spiral before it is formed into a rope. Preformed rope needs less-careful breaking in, is subject to less internal stress in use, handles more easily, and when individual wires are broken they lie in place and do not project to form "jaggers" which cut the hands of the men who handle the rope. Preformed rope is available from all major wire rope manufacturers.

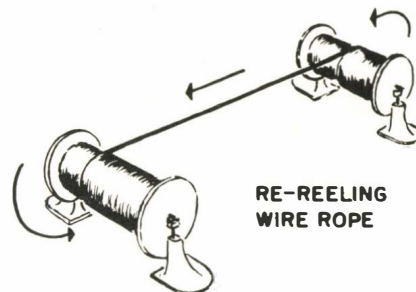
For most types of logging equipment right-lay rope is preferable. In this the strands spiral away from you toward the right as you look down a piece of the rope.

UNWINDING WIRE ROPE

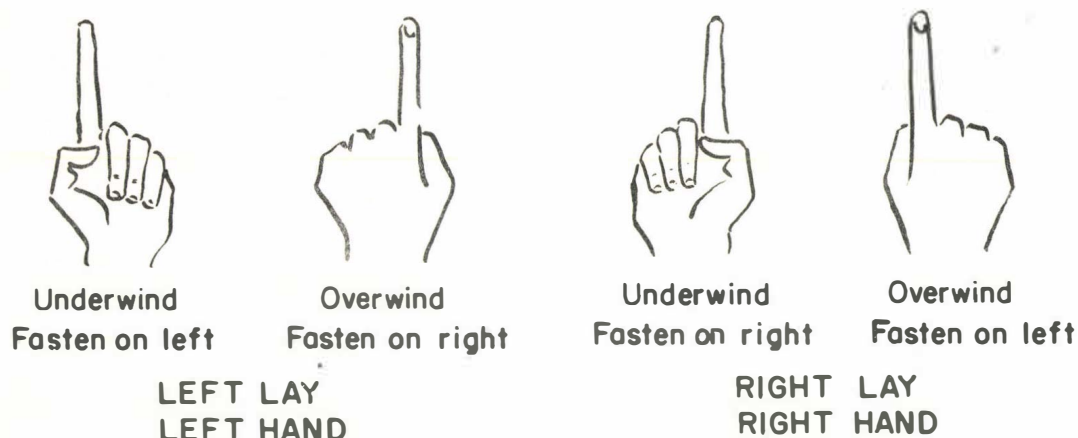
It is very important that wire rope always be unreeled and coiled up again in the same direction in order to avoid stresses and kinks. The proper way to unreel wire rope when you first receive it is to set the reel up on jacks and pull the rope off; or to hold the end, and roll the reel away from it. Throwing the rope off the end of the reel is certain to cause kinks and stresses.



When you re-reel rope from a horizontal reel to a drum, the rope should travel from the top of the reel to the top of the drum. Then, when the rope is led up over the arch and down over the horizontal fairlead pulley, it will continue to assume the same bend. By doing this you can avoid the continual flexing due to reverse bending in the rope as it is installed; and the rope will be much easier to handle and will last much longer. In some installations, including most loaders, reverse bends cannot be avoided.



In attaching wire rope to a winch drum, you should consider the type of rope. Right-lay rope should be fastened at the left end of the winch drum when the rope is wound over the top of the drum -- the proper method of attachment for most logging equipment, including loaders and arches. This makes for easy and regular spooling. If the socket for attaching the rope is at the right side of the drum, left-lay rope should be ordered for over-winding. If right-lay rope must be used on such a drum, it should be under-wound. An easy way to remember which way to wind wire rope is to use your index fingers, as illustrated.



SEIZING ROPE ENDS

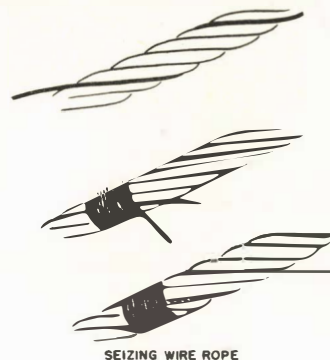
Preformed wire rope is the only kind that can be cut without first seizing it on both sides of the cut. Ordinary rope will brush out when cut, and several feet will be lost. Even preformed rope should be seized before cutting.

The number of seizings recommended by the U. S. Bureau of Mines for regular-lay wire rope, and specifications for the seizings, follow:

Rope diameter (inches)	Number of seizings		Length of seizings (inches)	Space between seizings (inches)	Diameter of seizing wire (inches)
	Hemp	I.W.R.C.			
0 - 1/2	2	3	1/2	1	.02 - .03
9/16 - 7/8	3	3	1	2	.04 - .06
1 - 1-1/4	3	4	1-1/2	2	.06 - .09
1-3/8 - 1-5/8	4	4	2	2	.08 - .125
1-3/4 - 2	4	4	3	2	.105 - .125

Seizing wire should be of annealed iron grade. It is important that the seizing be wrapped tightly, and yet that it is not strained.

To make a seizing take a piece of soft iron wire, and wrap it in a spiral along the grooves in the lay of the rope about three turns, then start wrapping the soft wire snugly back over this spiral, directly around the rope until the proper length is wrapped. Then tightly twist together the end first left and the end of the last wrap. Clip the ends off and hammer the twisted end down into a valley in the rope.

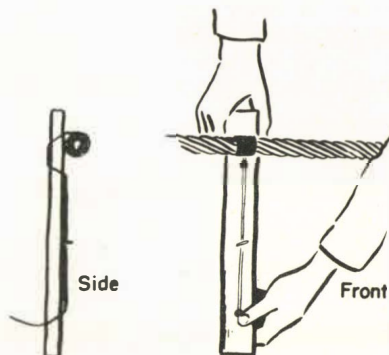


SEIZING WIRE ROPE

A seizing iron, with a spool in the end, as illustrated, is a big help in doing this job right on the larger sizes of rope. Lacking it, you can use a short length of round iron bar or a wooden stick with a hole in one end and a notch in the other.



SEIZING IRON



BINDING STICK

To cut a piece of wire rope, first put the required number of seizings on each side of the place where the cut is to be made. Smaller-diameter rope can be cut with any of the various kinds of clippers on the market, with a hacksaw, or with a hammer and cold chisel on an anvil. For the larger-diameter ropes it is best to use one of the special rope cutters, like the one illustrated here. This is merely a specially-tempered cold chisel, mounted in a stand over an anvil. The top of the chisel bar projects so that it can be hit with a sledge. A wedge holds the chisel bar in place.



WIRE ROPE CUTTER

Another excellent way to cut wire rope that is not to be used in splices or ferrules is with an acetylene torch. This will weld the ends of the wire in the strands together, and provide extra insurance against unlaying or high stranding.

FITTINGS FOR WIRE ROPE

Two methods of finishing the ends of wire rope for attachment to the various logging devices are common. The first is the ferrule, or socket. The second is the loop.

Logging lines can be purchased from the factory already fitted with a spliced eye at one end and a ferrule at the other. But, cables will break, attachments will come loose, and the equipment must often be adapted for different uses. Therefore, the installation of the ferrule and the loop will be described in detail.

The Ferrule

This is a ring of special alloy steel, tapered on the inside. When properly attached to the end of the rope, this socket will develop the full strength of the wire rope.

It is the only device that can be depended on to do this. Because the ferrule is strong and easy to use, it is fast becoming the most common end-fitting for logging rope. Most winch drums are designed to take a ferrule fitting. The Bardon choker and drawbar hooks (described in the section on "Skidding with Tractors") also call for ferrules.



FERRULE IN
CROSS SECTION

The ferrule is not difficult to attach. The special equipment needed is socket metal (or pure zinc), a ladle, a source of heat to melt the metal, and muriatic acid (or sal-ammoniac). Solder or babbitt are too soft for use in attaching sockets. To install a ferrule, follow these steps:



1. Measure from the end of the rope a distance equal to the length of the ferrule. If the wire rope is not preformed, apply not less than three seizings below this point. If it is preformed, only the top seizing will be necessary.



2. If the rope has a hemp center, cut this out level with the top seizing. If it has an independent wire rope center, leave this in.



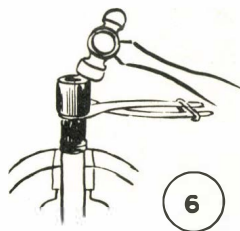
3. Separate the wires of the various strands to form a brush. It is not necessary to straighten these wires.



4. Clean the wires carefully with gasoline, benzine or naphtha for the distance they are to be inserted in the socket. Dry thoroughly.



5. Then dip the ends of the wire in muriatic acid solution (50% commercial muriatic acid, 50% water) for about 30 seconds. Do not let the acid come in contact with the hemp center or any portion of the rope but the broomed ends. Then neutralize the acid by dipping into boiling water to which a pinch of soda has been added. (An alternative to the acid bath is to go ahead with step 6, and then sprinkle a little sal-ammoniac down between the strands as a flux and cleansing agent).



6. Pinch the broomed-out ends together with a special pair of tongs, as illustrated, or pull them together with a short piece of seizing wire; and drive the ferrule over the ends of the strands down to the top seizing.



7. Distribute the wires evenly in the recess. Do not crimp over the ends — this makes the socket weaker instead of stronger. Place a seal of putty, clay, or mud around the base of the socket.



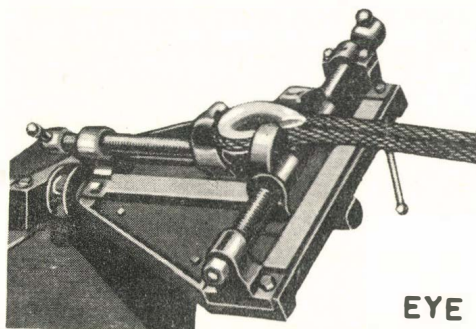
8. Melt the socket metal. Do not get it too hot or it will anneal the wires. If a wood sliver dropped into it chars, but does not burst into flame, it is about the right temperature. Before pouring it into the socket it is a good idea to heat the latter slightly to drive off any moisture that may have collected. Fill the socket brimful, because the metal will contract a little when it cools.

The Loop

Several types of loop are used on the end of logging ropes. A spliced-eye loop, without thimble, is generally preferred. This provides maximum flexibility. However, some loggers believe that the insertion of a thimble provides a loop almost as flexible, and one that wears longer and is much safer. A properly spliced eye—with or without thimble—will develop 80% or more of the original strength of the rope.

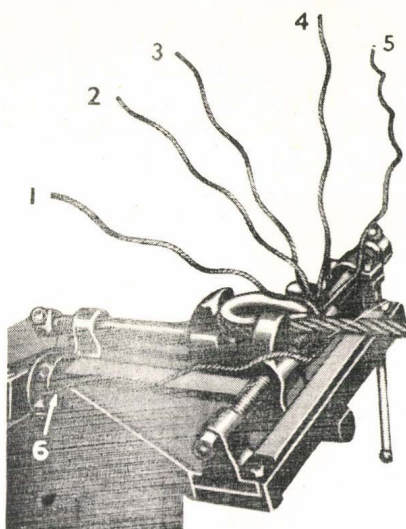


In making an eye splice a rigger's vise, as illustrated, is a big help. An ordinary vise can be used a little less handily. You also need a marlinspike, pliers, a length of manila rope and a length of pipe, two wooden mallets, seizing wire, a rope knife, and a pair of cutters.



1. Place a thimble of the correct size about 2 feet from the end of the wire rope and bend the rope around it. If a thimble is not used, a wooden block of the same exterior size should be used instead. Clamp the entire assembly tightly in the rigger's vise.

EYE SPLICE
STEP 1



STEP 2

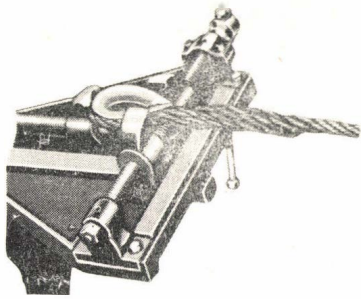


STEP 3

2. Untwist the 2-foot end of the rope. If the rope is not preformed, apply a seizing of fine wire to each strand. If it is preformed, this is not necessary, but the strands should be straightened somewhat. Cut out the center of the rope. If it is hemp, cut it out close to the thimble. If it is wire, cut it a fraction of an inch away from the thimble. Bend two strands to the left, and four to the right, to make the four-truck splice which is favored in logging. Loosen the lay of the standing part of the rope by wrapping the doubled hemp rope five or six times around the wire rope about 2 feet from the thimble, inserting the pipe in the loop at the end, and turning it in the direction of the lay.

3. Insert the marlinspike under the two strands close to the point of the thimble. Give it a half turn to the right and insert strand No. 1 in the opening. Force this strand up against the thimble with the marlinspike. Tuck strand No. 2 under the next single strand in the long end of the rope, using the same procedure as for strand No. 1. Next tuck strand No. 6 under the two strands which are fifth and sixth from the point of the thimble. Then insert strand No. 6 upward under the fifth strand in the standing rope. Give strand No. 5 three more tucks, going over one and under one strand—pulling the strand up through the opening each time—until the fourth or last tuck, which you make by pushing the strand down through the tuck. Repeat this procedure with strands No. 4 and No. 3, taking the next laid strands as they come in order on the long end of the rope. Complete splicing of strands No. 2, No. 1, and No. 6 in the order given by giving each three more tucks.

4. Cut off the long ends of the strands that project, and hammer out all inequalities between the two wooden mallets.



STEP 4

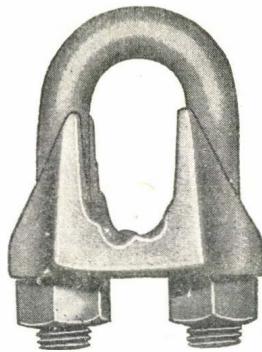
Finally, apply seizing wire to the entire splice so it will not cut the hands of the men who will handle the rope. Loosely spiral 6 or 8 inches of soft wire down around the splice from the point of the thimble; then wind it back up over the splice, tightly and uniformly, to the point of the thimble. Twist together the two ends and tap them with a mallet so they lie close to the rope.

A splice made in this manner should develop 80 to 90% of the strength of the original rope in the sizes used in the Northeast. The first splices you make may look a little ragged; but they will be about as strong as a smoother job.

The clips and knots so frequently used by Northeastern loggers do not develop anywhere near the strength of the spliced eye. Clips should be used on live lines only as an emergency measure. They are bulky and will not go through the fairlead or sheaves properly; they are difficult to handle; and they are a continual cause of accidents. The use of clips should be confined to guy lines and other stationary cables.

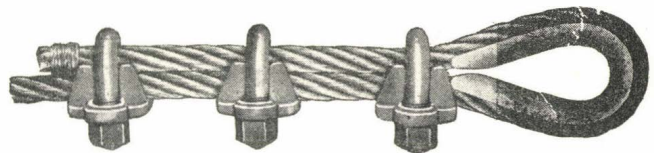


THIMBLE



CLIP

When you use clips, make sure that the base of the clip is applied to the live end of the rope, and the U-bolt to the dead end. If the clips are put on opposite sides, or staggered, the loaded rope will be deformed, and its strength will be reduced.



CORRECTLY APPLIED

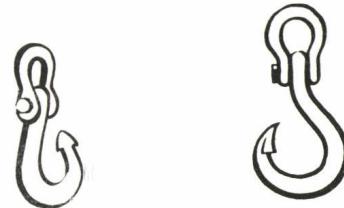


CABLE LOCK LOOP

Recently two types of locking collars have appeared on the market. They do the same job as the splice eye. One, illustrated here, can be put on by the logger. Another type is installed only at the factory. Experience in the woods has not yet been adequate to prove the worth of these collars.

Hooks and Chokers

To these various eye loops can be attached any of the special choker hooks equipped with pins or clevises such as those illustrated here. The arrow points help to keep the chokers attached during rough going.

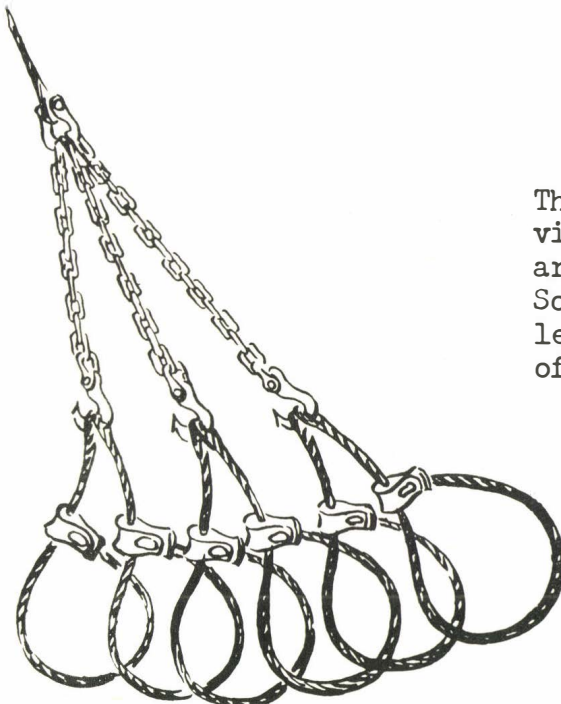


TRACTOR ARCH HOOKS

By means of clevises, one or more of the Bardon patent arch hooks can be attached to the eye loop, making possible the use of chokers with ferrules at both ends. These have the advantage of being reversible, and they wear longer and more evenly.

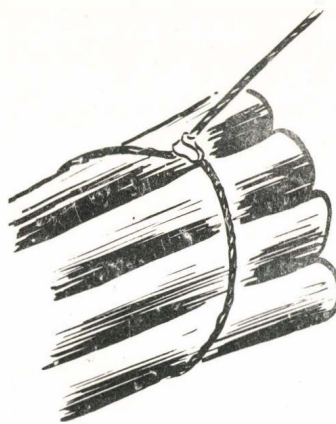


BARDON ARCH
HOOK



MULTIPLE CHOKER ASSEMBLY

The combination of these and other devices that can be used on the end of an arch line cable are practically endless. Some operators use three or four short lengths of chain to multiply the number of chokers that can be attached.

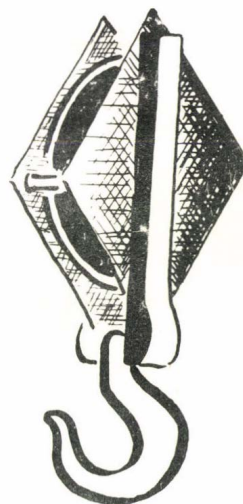


SINGLE
CHOKER
ASSEMBLY

Others sling the main dragline around a cord or more of tree-length poles, attach the free end to the line with either a patent or an ordinary choker hook, and drive off with the entire load. The best combination for any situation will depend on the size of the timber, local skidding conditions, and the preferences of the men doing the work.

Blocks

The life of wire rope depends partly on the kind of blocks used with it. On many Northeastern logging jobs, ordinary cargo or hayloft blocks are used. These farmers' blocks have flat steel sides, soft sheaves, and crude bearings. Wherever these blocks are used, the rope soon shows signs of abuse. It is practically impossible to keep the flat steel sides from abrading the rope.



LOGGER'S BLOCK

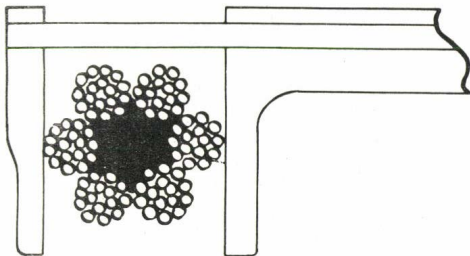


It is far better, in almost every case, to get genuine loggers' blocks with smoothly rounded sides, manganese steel sheaves, and sturdy anti-friction bearings. These blocks cost more, but they wear better, rope lasts longer, and the danger of accidents is greatly reduced.

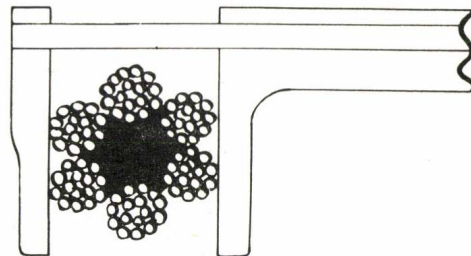
When you do get loggers' blocks, take out the cotter pins that hold the clevises in place, and replace them with short pieces of soft steel wire, twisted together. The wire will not catch on everything, and will not break off and fall out as the cotter pins might.

In buying blocks you should consider the size of the sheave and the size of the groove in it. Manufacturers advise that 6 x 19 wire rope should not be passed over a sheave less than twenty times the rope diameter. This means that for 1-inch rope you should not use a sheave less than 20 inches in diameter; for 3/4-inch rope, 15 inches, and so on. It is frequently impractical to install sheaves this big in logging equipment but these sizes should be approached as closely as possible.

RIGHT

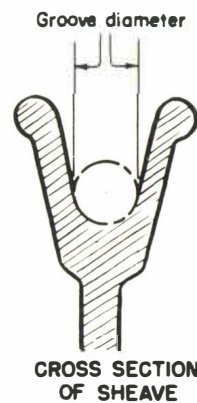


WRONG



Measuring wire rope diameter

It is even more important that the groove in the sheave is the right size. Sheaves with proper groove sizes are available for each of the commonly used sizes of wire rope, and no other size of groove should be used. Too narrow a groove will pinch the rope, too wide a groove will not give it the proper support. Either will result in premature failure of the rope.



When you discard an old rope, check the size of the sheave groove before you install a new rope. Groove gages for this purpose are available from manufacturers. If a groove gage is not readily available, you can make one easily from a thin piece of sheet steel. Use the following measurements:

Diameter of rope (inches)	Correct diameter for groove gage
0 - 3/4	Rope diameter plus 1/16"
3/4 - 1-1/8	" " " 5/64"
1-1/8 - 1-1/2	" " " 3/32"

If the groove has been worn to a smaller or greater diameter, or has become rough or scored, the sheave should be taken to a machine shop and the groove turned to make it the right size and to take out the corrugations.

All sheaves should be kept lubricated so that they will rotate freely. This applies also to the rollers on fairleads, both horizontal and vertical. Ordinarily pressure-lubrication fittings are provided, but in some cases, the block has to be taken apart and an oil well filled.

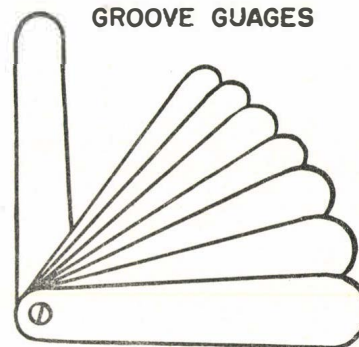
CARE OF WIRE ROPE

It is impossible to carry out all the recommendations of wire rope manufacturers in taking care of wire rope used on a logging job. But the more of them that you can follow, the longer your wire rope will last, and the fewer accidents will occur.

Kinks

A kink in a wire rope, no matter how it develops, greatly reduces the life of the rope. Consequently, every precaution must be taken, by proper and careful handling, to avoid making such kinks. Never let a small loop remain in a wire rope. Watch for such loops, and throw them out before kinks develop.

When a rope is kinked it is permanently damaged, and it can never be repaired short of cutting out the kink and splicing. Such a splice uses up from 10 to 20 feet of rope. A generous use of swivels in wire rope installations will help to reduce kinks.

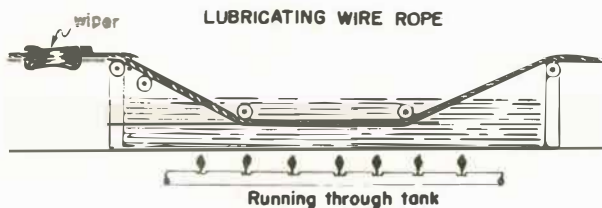
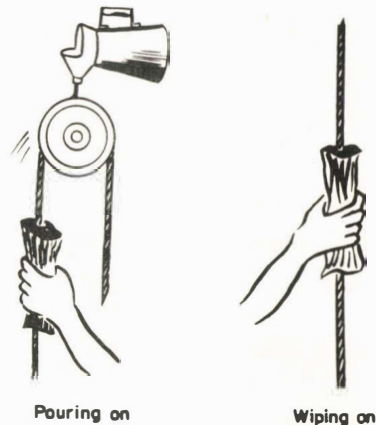


Lubrication

All wire rope should be kept lubricated. A wire rope should be considered a machine; in the course of jerking and loosening, flexing and unflexing, its metal surfaces rub against each other as they do in other machinery. Most wire rope manufactured today is completely lubricated as it is formed, but this lubrication will not last indefinitely, especially in service such as logging, where the rope is subjected to dragging through mud, snow and slush, and is left out in all sorts of weather. The notion that the lubrication in the hemp center is a reservoir for the rest of the rope to draw on is absolutely false. A different kind of lubricant is needed for the fiber than for the steel, and the hemp should never be allowed to get dry.

For most logging service a medium-heavy lubricant, free from both alkalis and acids, should be used. Heavy lubricants that have to be heated before being applied are not needed, and light lubricants are suitable only for inside use. Special wire-rope lubricants are available from the wire-rope manufacturers.

The frequency of lubrication will depend on the use which the rope is getting. The heavier the loads, the greater the number of bends, the smaller the sheave diameters, the higher the rope speeds, and the more severe the corrosive conditions; the more frequent must be the lubrication. If the rope remains pliable, with evidence of lubrication between the strands, it generally does not need lubrication.



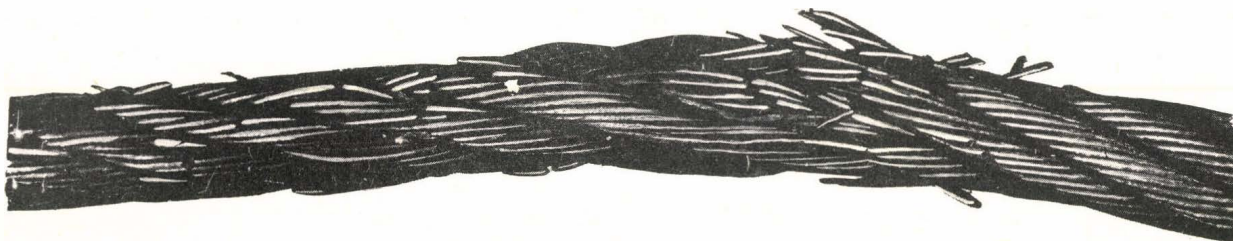
The lubricant can be applied by pouring it on from the top as the rope is flexed over a sheave, by wiping it on with a rag, or by running the rope through a vat or tank. Whatever the method, surplus lubricant should be wiped off the surface after lubrication. A piece of burlap is a good wiping rag. Lubricant should never be poured on rope spooled on a reel or drum.

Inspection of Wire Rope

In the interest of economy and safety, all wire rope used in logging should be inspected at regular intervals. Such inspections may reveal conditions that are wearing the rope out prematurely; and thus make it

possible to correct them and prolong the rope's life. Inspections may prevent serious accidents. Frequently, when only a portion of the rope is found to be breaking down, a section can be cut off, or the rope can be turned end for end. In other cases it may be desirable to retire a whole length of rope to some other use and put new rope in the main drag-line or in the main lead on a skidder or loader. Some of the things to look for in rope inspection follow.

Kinks are the most frequent cause of sudden breakage of wire rope. The only thing to do when a kink is found is to cut it out, and make a long running splice in the rope — which will take 10 to 20 feet — or discard the shorter section.



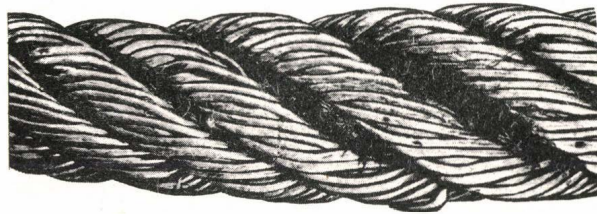
When the sheave grooves are too small, they pinch the rope. A different block should be installed, a different size rope installed, or the sheave groove should be turned to the correct size as soon as this type of damage is noted.



When a heavy load has been supported over a sheave groove that is too large, or the rope has not spooled tightly on a drum it will flatten out. The I.W.R.C. rope recommended for arch lines is less subject to this sort of damage than hemp-center rope. Correct spooling is frequently difficult in arch logging, but there is little excuse for improper sheaves.



When a section of wire rope rubs against some sharp object such as the side of a farmers' block, or when there is excessive bending around sheaves that are much too small, the outside wires will crack. A drag line that is pulled along the ground at high speed will be hardened by friction, and then if it is bent around a too-small sheave the hardened outside wires will crack rapidly.



Small nicks between the rope strands, or inside the rope against the wire center, are usually evidence of overloading. These are frequently easy to overlook, but they weaken the rope considerably. Ropes that aren't over-loaded won't develop them.

Modern wire ropes will stand a lot of abuse, but a little extra care, along the lines suggested in this publication will repay its cost several times over. The misused wire rope on many Northeastern logging jobs is delivering only a fraction of the service it should and provides a continual threat of serious accidents.

SOME MANUFACTURERS OF WIRE ROPE

USED IN THE NORTHEAST

A. Leschen and Sons Rope Co.
87-90 West St.
New York 6, N. Y.

MacWhyte Co.
Kenosha, Wisconsin

John A. Roebling and Sons
640 S. Broad Street
Trenton, N. J.

Union Wire Rope Corp.
21st and Mauch Ave.
Kansas City, Missouri

Wickwire Spencer Steel Co.
500 Fifth Avenue
New York 18, N. Y.

Wire Rope and Equipment Co.
Seattle, Wash.

American Cable Division
American Chain and Cable Co.
Philadelphia 25, Pa.

American Steel and Wire Co.
71 Broadway
New York, N. Y.

Bethlehem Steel Co.
Bethlehem, Pa.

Broderick and Bascom Hope Co.
4203 N. Union Boulevard
St. Louis, Mo.

Gilmore Wire Rope Division
Jones and Laughlin
Muncy, Pa.

Hazard Wire Rope Division
American Chain and Cable Co.
Wilkes-Barre, Pa.

SOME MANUFACTURERS OF LOGGERS' WIRE ROPE FITTINGS

USED IN THE NORTHEAST

Electric Steel Foundry
2141 N.W. 25th Ave.
Portland, Ore. (2)(3)

Skookum Company
8504 N. Cranford St.
Portland, Ore. (1)(2)(3)(4)

Paul E. Keeney Co.
Weatherly Bldg.
Portland, Ore. (4)

Berger Eng. Works
3236 16th Ave. S. W.
Seattle (4) Wash.

Young Iron Works
Seattle, 4, Wash.
(1) (2) (3) (4)

Mallory Logging Equip. Co.
133 S. W. Pine St.
Portland, Ore. (1)(2)(3)(4)

Lamb-Grays Harbor Co.
Hoquiam, Wash. (4)

1-Standard Choker Hooks
2-Bardon Choker Hooks
3-Dragline Hooks, Swivels & Clevises
4-Loggers' Blocks